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ABSTRACT

Under the National Uranium Resource Evaluation (NURE), massive amounts of geological, geochemical, and geophysical data, covering the entire conterminous 48 states and Alaska, are being collected and made public. In addition to NURE goals, these data are applicable to various other researches on and in the vicinity of lands controlled by the National Park Service. Airborne geophysical and hydrogeochemical survey NURE data have been made public for the majority of the area in the combined Mt. McKinley National Park and Denali National Monument. Besides indicating potential raw material deposits, these data are also useful for geologic mapping, water quality, pollution and other geological, biological, and environmental studies in the park.

INTRODUCTION

The National Uranium Resource Evaluation (NURE), begun in 1974 and slated for completion in 1988, is a US Department of Energy (DOE) program that has as its major goal the establishment of reliable and timely comprehensive estimates of the nation's uranium resources. The Grand Junction Office of DOE is responsible for the NURE program management.

In order to collect, analyze, and evaluate the information necessary to meet its major goal, the NURE has been divided into seven operating elements: airborne radiometric reconnaissance (ARR); hydrogeochemical and stream sediment reconnaissance (HSSR); subsurface geologic investigations; geologic studies; technology applications; quadrangle evaluation; and information dissemination (Bendix Field Engineering Corp. 1979). The ARR and HSSR are designed to collect geophysical and geochemical data from the entire conterminous 48

states and Alaska that will aid in the identification of areas that are more promising with respect to uranium mineralization. Subsurface geologic investigations are directed toward obtaining data to confirm uranium resource estimates or to evaluate areas thought to contain potentially uraniferous host rocks. Geologic studies are aimed at 1) examining the environments of uranium deposits that are major producers throughout the world and that could occur in the US, and 2) surveying and evaluating the potential resources tied up in intermediate-grade (0.01 to 0.05 percent U_3O_8) uranium deposits. The technology applications program provides the research on techniques, methodologies, and equipment for uranium exploration and resource appraisal. The quadrangle evaluation program collects and evaluates all data relevant to uranium resource potential and provides the information to the DOE and the public on the basis of $1^\circ \times 2^\circ$ or $1^\circ \times 3^\circ$ National Topographic Map Series (NTMS) quadrangles. The information dissemination element of NURE is responsible for releasing to the public all information generated by the other operating elements of NURE.

Data tapes containing the AAR and HSSR data may be purchased from: GJOIS Project, UCC-ND Computer Applications Dept., 4500 North Building, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee 37830. Microfiche of all NURE reports may be purchased through: Technical Library, US Dept. of Energy, P.O. Box 2567, Grand Junction, Colorado 81501.

A more detailed description of the function and status of each of the operating elements of NURE can be found in the NURE Annual Activity Report (Bendix Field Engineering Corp. 1979). Because of their general applicability to researches in and around various units of the National Park Service System, the types and uses of reconnaissance data collected in the ARR and HSSR will be discussed below.

AIRBORNE RADIOMETRIC RECONNAISSANCE

The ARR generates high sensitivity radiometric and aeromagnetic data. These data, collected at an average altitude of 120 m above ground level by private contractors, provide excellent information for the delineation of geologic structure and the identification of some surficial units. The average spacing between flight lines is 5 km. To date, more than one million flight-line kilometers have been flown. Figures 1 and 2 illustrate the status of the ARR for the conterminous 48 states and for Alaska, respectively. Data are reported on the basis of NTMS quadrangles.

HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE

The HSSR involves the collection of field data and small samples of ground water, surface water, stream sediment and/or lake-bottom sediment, the analysis of these samples for uranium and other elements, and the reporting of these data on the basis of NTMS quadrangles. Three national laboratories are responsible for conducting the HSSR: Savannah River Laboratory in the eastern and far western

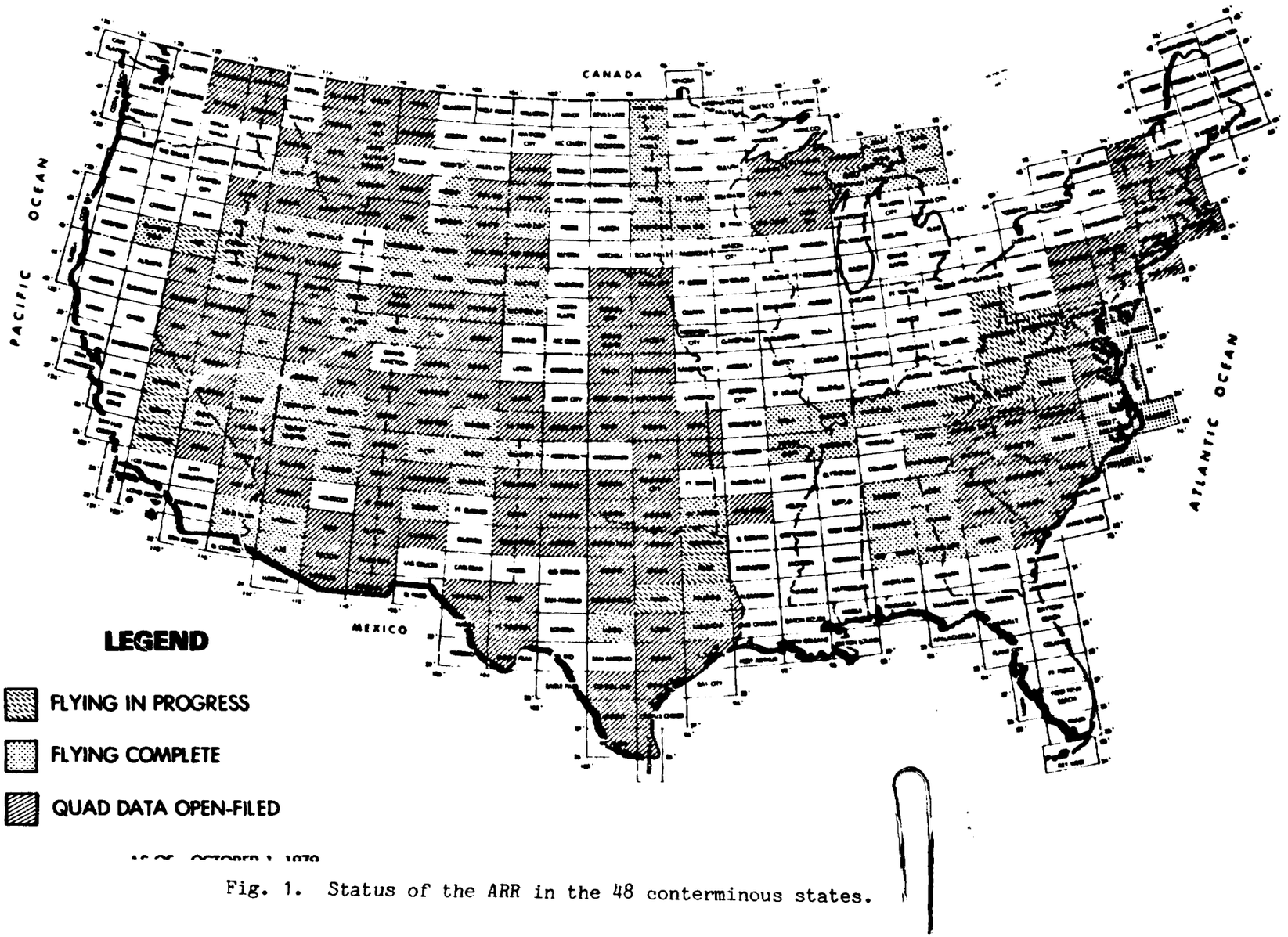

Fig. 1. Status of the ARR in the 48 conterminous states.

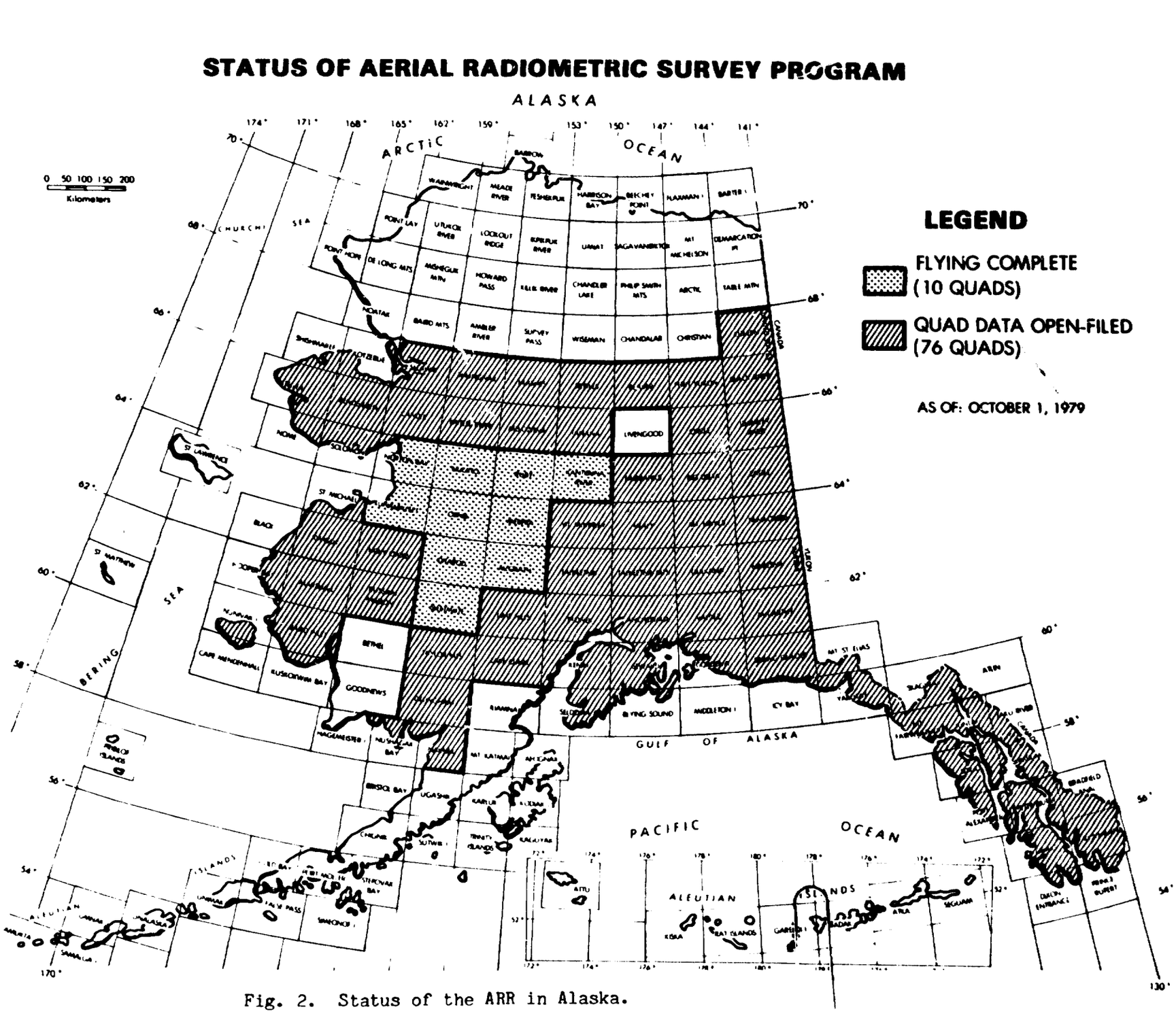

Fig. 2. Status of the ARR in Alaska.

states, Oak Ridge National Laboratory in the Great Plains states, and Los Alamos Scientific Laboratory (LASL) in the Rocky Mountain states and Alaska.

Each laboratory utilizes different field and analytical procedures and analyzes their own samples for different suites of elements. Where possible, one water and one sediment sample are collected from a sample location at a density of one location every 10 to 15 square kilometers in the lower states and mountainous regions of Alaska and one location every 23 square kilometers in the lake-covered areas of Alaska. As a result, by the end of the program, samples will have been collected from more than one million locations throughout the conterminous 48 states and Alaska. All field and analytical data for these locations are being made public as soon as possible after sample collection and analysis. Figures 3 and 4 illustrate the status of the HSSR program in the conterminous 48 states and in Alaska, respectively.

In the field, air and water temperature, water conductivity and pH, and scintillometer readings as well as general observations on weather, geology, general site characteristics, and possible sources of contamination are recorded by the LASL at each site. The LASL's water samples are analyzed for calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, titanium, zinc, and uranium. Uranium concentrations in water samples are determined by fluorometry and the concentrations of all other elements in water samples are determined by plasma-source emission spectrography. The LASL's sediment samples are analyzed for aluminum, antimony, barium, beryllium, bismuth, cadmium, calcium, cerium, cesium, chlorine, chromium, cobalt, copper dysprosium, europium, gold, hafnium, iron, lanthanum, lead, lithium, lutetium, magnesium, manganese, nickel, niobium, potassium, rubidium, samarium, scandium, silver, sodium, strontium, tantalum, terbium, thorium, tin, titanium, tungsten, uranium, vanadium, ytterbium, and zinc. Sediments are analyzed by delayed-neutron counting for uranium, by neutron activation analysis for 31 elements, by x-ray fluorescence for 9 elements, and by arc-source emission spectrography for 2 elements. All elemental analyses are performed at the LASL and the Laboratory is capable of analyzing the water and sediment samples from more than 50 000 sample locations per year.

NURE DATA AND RESEARCH IN UNITS OF THE NATIONAL PARK SYSTEM

More than 80 million acres are presently included in units controlled by the National Park Service, 50 million acres of which were recently proclaimed as National Monuments in Alaska. The 80 million acres would normally yield approximately 20 000 HSSR sample locations and more than 50 000 flight-line kilometers of ARR data. NURE airborne radiometric data, aeromagnetic data and HSSR trace element data are presently available to the public for areas covering all or most of several units in the National Park System (e.g., Arches National Park, Big Bend National Park, Canyonlands National Park, Denali National Monument, Mesa Verde National Park, and Mt. McKinley National Park).

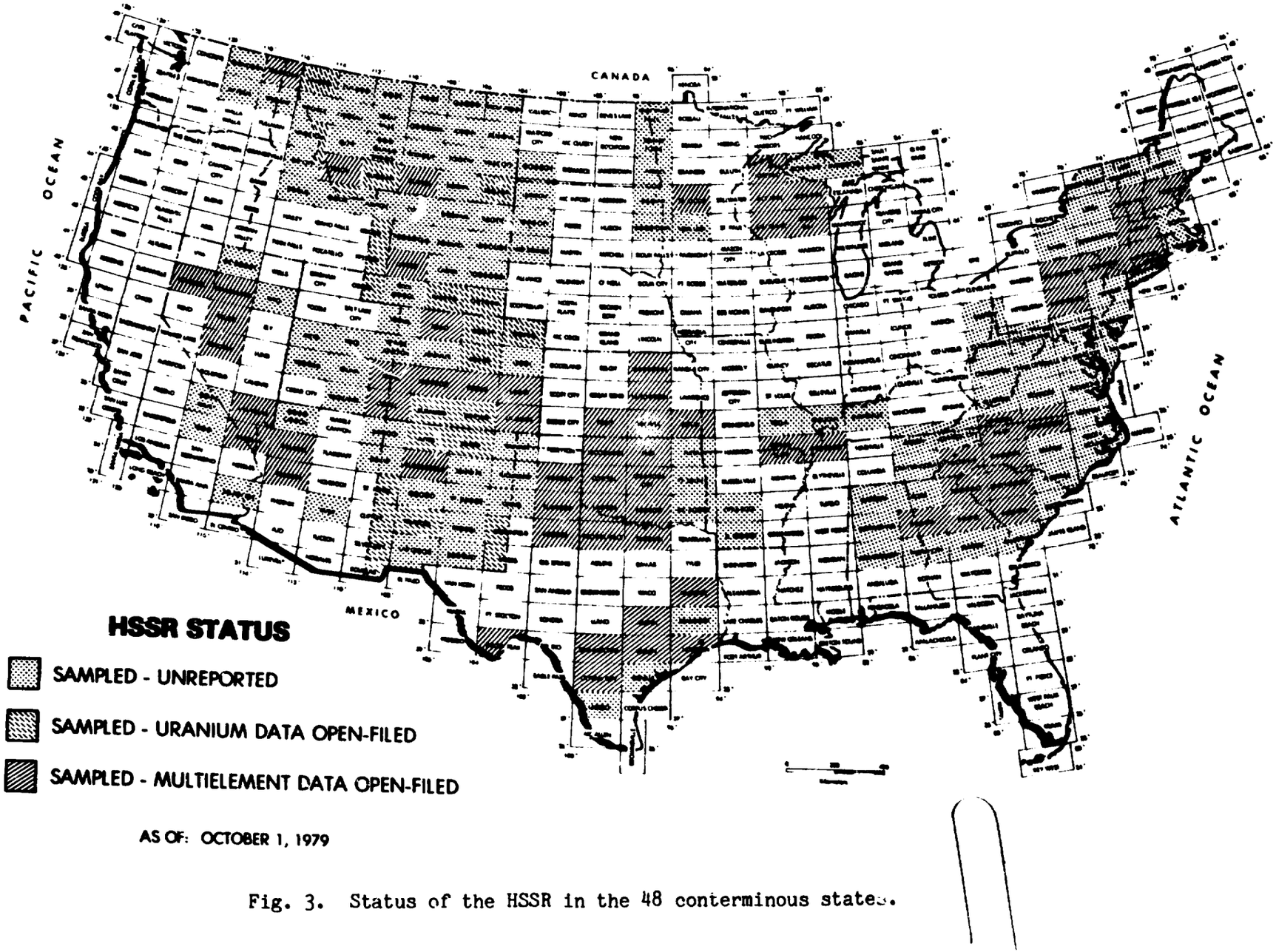

Fig. 3. Status of the HSSR in the 48 conterminous states.

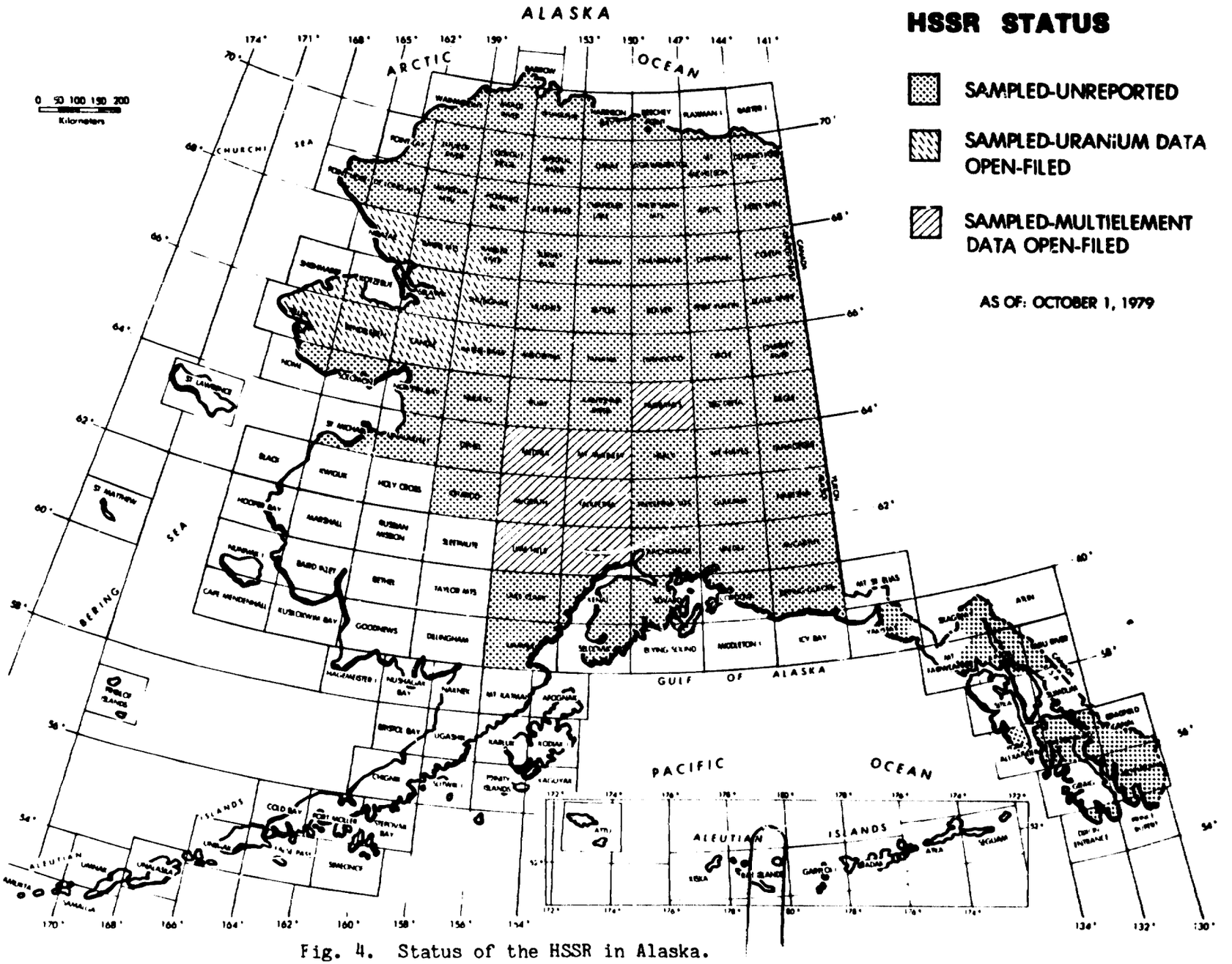

Fig. 4. Status of the HSSR in Alaska.

An excellent example of the utility of NURE data to researches in the National Parks is provided by the data from the Mt. McKinley National Park and its proposed extension, the Denali National Monument. Figure 5 illustrates the location of these two units of the National Park System. The ARR data are available for the Mt. McKinley, Talkeetna, Fairbanks, and Healy NTMS quadrangles (Texas Instruments 1978). HSSR multielement data are available for the Mt. McKinley and Talkeetna quadrangles (Aamodt et al 1979; Van Eeckhout et al 1979).

Surface water and sediment samples were collected from approximately 1050 locations in the combined areas of the Mt. McKinley National Park and Denali National Monument. However, only the data from the Mt. McKinley and Talkeetna quadrangles, the shaded area in Fig. 5, have been made public. In these two quadrangles, approximately one-half of the 1250 total sample locations are inside the National Park or National Monument. The multielement data for the samples from the 1250 sites have been examined. Contoured plots of elemental concentration vs. location were compared with available geologic, hydrologic, and mining data for the area. The observations, listed below, from these comparisons suggest many applications of these data to other researches in geology, geochemistry, biochemistry, and environmental sciences in the National Park System. The observations are:

1) The highest concentrations of uranium, copper, iron, and zinc in both water and sediment samples and of antimony, chromium, cobalt, nickel, and vanadium in sediments correlate exceptionally well with the known mining districts in the area (e.g., Kantishna, Camp Creek, Chulitna-Yentna, and Shellabarger Pass). Other areas, previously unknown, are indicated that may contain significant amounts of these strategic raw materials.

2) The elemental concentration data for sediments and ratios of elemental concentrations are useful tools for geologic mapping. Each geologic unit appears to have its own distinctive suite of trace elements. The high calcium concentrations in waters and sediments correlate very well with the outcrops of Mesozoic and Paleozoic strata on the northern flank of the Alaska Range. The granitic intrusives (Mt. Estelle pluton, Ruth pluton, etc.) are delineated by high concentrations of uranium and rare earths in sediment samples.

3) The geology of the northwestern quarter of the Mt. McKinley quadrangle is mapped as various alluvial and glacial units; the topography is relatively flat. However, the various trace element data for both waters and sediments show considerable character in this area, suggesting a fair amount of hidden structure.

4) The lead values in sediments are far lower in this area than for areas of similar geology in the Rocky Mountains. In fact, a large percentage (~50%) of the lead in sediment values are below the detection limit of 5 parts per million, whereas in the Rocky Mountain areas only 15% or less are generally below the detection limit. This observation suggests that Alaska may as yet be relatively free from

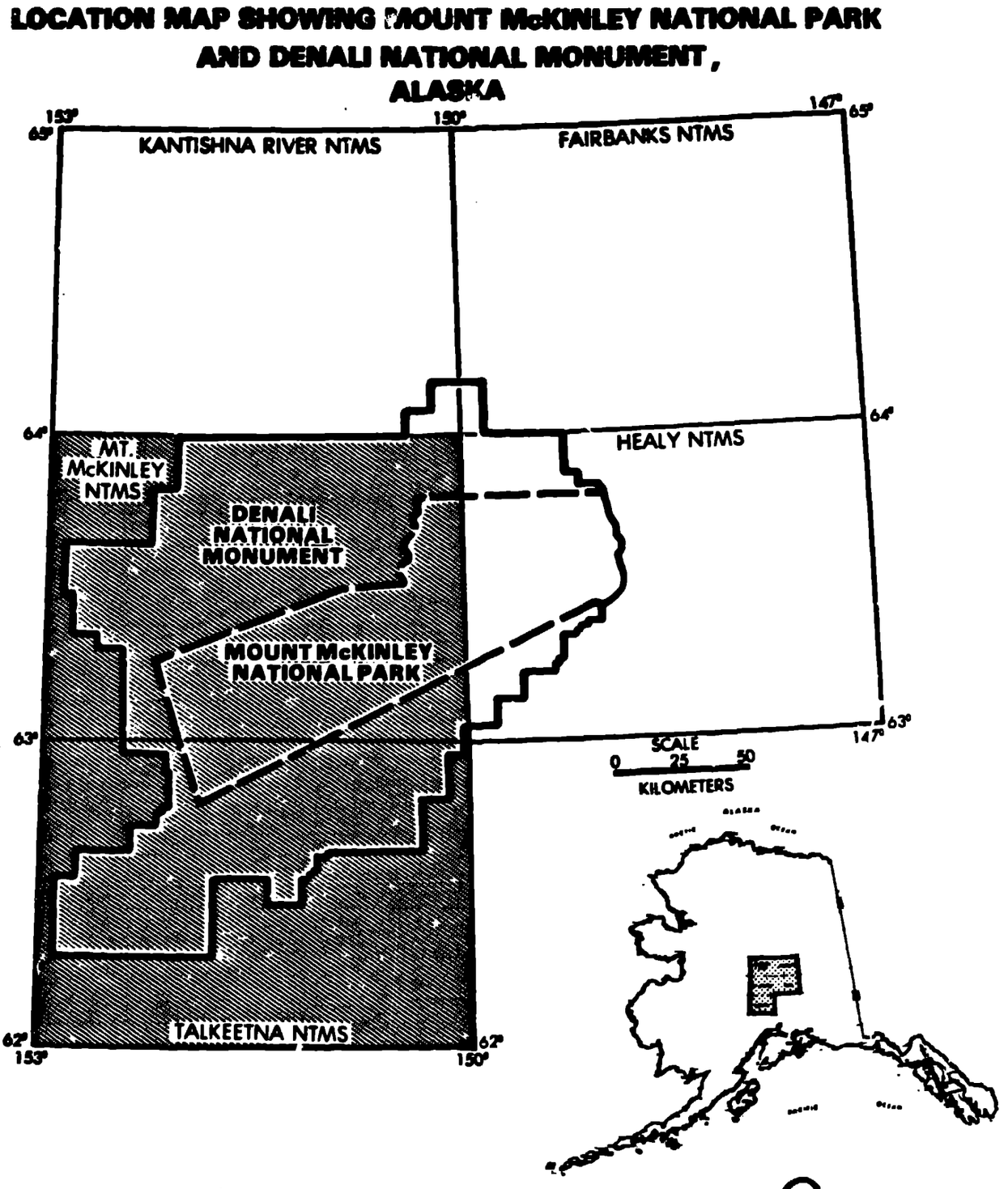

Fig. 5. Location map for the Mt. McKinley National Park and Denali National Monument, Alaska.

automotive-emission pollution. However, far more research is required to substantiate this hypothesis.

3) The field data, together with the trace element data in water samples, provide significant information regarding water quality and pollution. In Alaska, dissolved oxygen measurements are also made at each water sample location.

SUMMARY

The US DOE is conducting a nationwide evaluation of the uranium resources in the US. The high quality geological, geochemical, and geophysical data required for this task are also very useful in other researches, particularly those ongoing in the various units of the National Park System. All data obtained for NURE will be made public by 1988, the completion of the project. Many reports containing these various data are open filed to the public each year by the Grand Junction Office of the DOE.

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